



# Dynamic Indicators of Basic Early Literacy Skills

## 8<sup>th</sup> Edition

Dimensionality of the DIBELS 8 Composite Score

Technical Report# 2003

University of Oregon  
Center on Teaching and Learning

## Dimensionality of the DIBELS 8 Composite Score

DIBELS 8 is a set of procedures and brief fluency measures used to assess the acquisition of empirically validated early literacy skills, identify students at risk of not meeting later reading goals, and monitor the development of those skills for students in kindergarten through eighth grade. Specifically, DIBELS 8 assesses phonological awareness, alphabetic principle and phonics, word knowledge, accuracy and fluency with connected text, and comprehension skills through six brief measures: Letter Naming Fluency (LNF), Phoneme Segmentation Fluency (PSF), Nonsense Word Fluency (NWF), Word Reading Fluency (WRF), Oral Reading Fluency (ORF), and Maze.

For all measures, students receive a score for the number of items identified correctly in 1 minute. For NWF, scores are provided for both the number of letters decoded correctly (NWF-CLS) and the number of non-words blended (NWF-WRC) skills. Similarly, ORF provides two scores, one for the number of words read correctly (ORF-WRC) and one for the percent of words read correctly (i.e., accuracy, ORF-ACC). Each subtest has been thoroughly researched and demonstrated to be a reliable and valid indicator of early literacy development. The subtests offered in specific grades are aligned to curriculum and instruction typical for each grade, as shown in Figure 1.

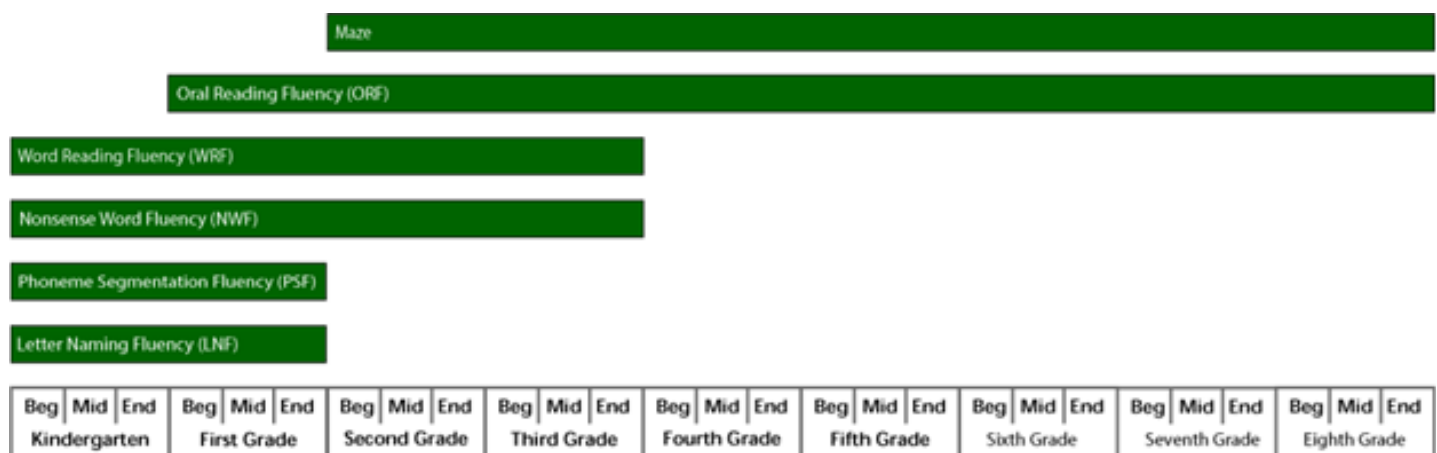


Figure 1. DIBELS 8 measure administration schedule by grade and time of year.

### Composite Scores

#### Conceptual Models

In addition to scores on each of the subtests, DIBELS 8 provides a composite score, which represents a weighted combination of the scores on all DIBELS 8 measures administered in each grade and thus, provides a robust estimate of overall student literacy skill. The composite score formulas were informed by multiple theoretically guided one-factor reading models. Specifically, a series of confirmatory factor analysis (CFA) models were specified based on theories of literacy development and literacy assessment and then tested to examine the extent to which the hypothesized structures fit the observed data by grade. Models were built using an iterative approach, starting with a

base model for each grade in which all DIBELS 8 measures were loaded onto a single, common reading factor. The base model was then extended by modeling different theoretically based covariances. The theoretical reading factor models for each grade are presented in Table 1.

**Table 1**

*Theoretical Reading Factor Models Tested by Grade*

| Grade | Model | Theoretical Reading Factor Models                              |
|-------|-------|----------------------------------------------------------------|
| K–3   | 1     | All available DIBELS 8 measures                                |
|       | 2     | All available DIBELS 8 measures + NWF-CLS – NWF-WRC covariance |
|       | 3     | All available DIBELS 8 measures + NWF-WRC – WRF covariance     |
|       | 4     | All available DIBELS 8 measures + ORF-WRC – ORF-ACC covariance |
|       | 5     | All available DIBELS 8 measures + ORF – WRF covariance         |
|       | 6     | All available DIBELS 8 measures + ORF-WRC – Maze covariance    |
| 4–8   | 1     | All available DIBELS 8 measures                                |
|       | 2     | All available measures + all covariances                       |

*Note.* Not all models are available in all grades, based on the measures administered.

In the reading factor models for grades K–3, modeling covariances for ORF-WRC and ORF-ACC and NWF-CLS and NWF-WRC) accounts for the residuals that arise from including multiple scores from the same test in the model. Modeling the ORF – WRF covariance accounts for residuals associated with multiple subtests that measure real word reading, while modeling the WRF – NWF-WRC covariance accounts for the residuals associated with multiple subtests that measure blending words. Finally, modeling the covariance between ORF-WRC and Maze accounts for the residuals associated with measuring reading comprehension.

### ***Analyses***

The composite score formulas were determined using a confirmatory factor analytic (CFA) approach. In determining the final model for each grade level, we took into consideration several factors. First, the model needed to make sense theoretically. Second, the model needed to fit the data reasonably well. Third, we wanted, to the greatest extent possible, consistency across grades, to facilitate score interpretation. Model fit was evaluated using five fit indices: the comparative fit index (CFI; Bentler, 1990; target criterion  $\geq .95$ ), the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993; target criterion  $\leq .06$ ), the standardized root mean square residual (RMSR; Hu & Bentler, 1998; target criterion  $\leq .10$ ), Akaike information criterion (AIC; Burnham & Anderson, 2004; lower values are better), and Bayesian information criterion (BIC; Burnham & Anderson, 2004; lower values are better). All models were estimated using maximum likelihood, based on DIBELS 8 data collected in the fall of the 2018-2019 school year as part of the larger DIBELS 8 norming study. Additional details about the schools and students included in

that sample is provided in the DIBELS 8 Technical Manual (University of Oregon, 2020a).

## ***Results***

**CFA Results.** A summary of CFA model results by grade is presented in Table 2. As shown in the table, not all grades had a CFA model that fit all model fit criterion. In those cases, we prioritized models that aligned with our other criteria. Based on those results, the factor model selected across grades K–3 was Model 5, which included the available DIBELS 8 measures for each grade and the NWF-CLS – NWF-WRC covariance. The factor model selected for grades 4–8 included all the available DIBELS 8 measures but no covariances. In all final reading models, all of the unstandardized factor loadings were statistically significant.

**Composite Score Calculations.** To compute composite scores, we employed the *regression method* (Thurston, 1935) to combine scores on DIBELS 8 measures. That is, DIBELS 8 composite scores are calculated as a sum of the weighted, standardized observed values of the measures included in the estimated latent reading factor for a given grade, using a mean of zero a standard deviation of 1, and a scaling constant based on the time of year in which the measures are administered. As a multivariate procedure, this approach accounts for the correlations among the observed variables as well as the correlations between the factors and between the factors and observed variables (DiStefano, Zhu, & Mîndrilă, 2009). Additional information about and examples of computing the composite score are available in the DIBELS 8 Composite Score Calculation Guide Supplement (University of Oregon, 2020b).

**Table 2***DIBELS 8 Composite Score CFA Results by Grade*

| Grade | CFI   | AIC       | BIC       | RMSEA | SRMR  |
|-------|-------|-----------|-----------|-------|-------|
| 0     | 0.844 | 8661.882  | 8700.529  | 0.323 | 0.076 |
| 1     | 0.938 | 26316.681 | 26382.022 | 0.175 | 0.061 |
| 2     | 0.993 | 7148.221  | 7190.703  | 0.076 | 0.025 |
| 3     | 0.987 | 8446.070  | 8490.933  | 0.108 | 0.020 |
| 4     | >.999 | 3439.950  | 3420.930  | <.001 | —     |
| 5     | >.999 | 2930.558  | 2950.641  | <.001 | —     |
| 6     | >.999 | 2581.598  | 2600.621  | <.001 | —     |
| 7     | >.999 | 1126.461  | 1140.204  | <.001 | —     |
| 8     | >.999 | 826.151   | 839.468   | <.001 | —     |

## References

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